**Table C: Data Values for the Tag Type Field**

| Decimal Value | Description |
|---|---|
| 1 | Reserved |
| 2 | Tag described by this AAR Standard and American Trucking Associations Standard |
| 3 | Multiple Frame Tag |
| 4 | Reserved |

To code the Tag Type value into the tag, the decimal value is reduced by one and converted to its base 2 equivalent.

### 1.3 Chassis Mark

The Chassis Mark is composed of four (4) letters and can be represented as C1; C2; C3; C4. To code this information in the tag, the possible letters represented by C1 will be assigned to the following decimal values: A=0, B=1, C=2, ....Z=25. The letters C2, C3 and C4 will be assigned the following values: Blank =0, A=1, B=2, ...Z=26. This code assignment allows for a Chassis Mark of less than four characters, with the actual characters left justified, and the remainder of the field padded with blanks.

Conversion from alpha to numeric would involve the following:

1. Determine the numeric equivalent of characters C1 through C4. This will result in four numeric values; N1 through N4.

2. Convert N1 through N4 into one numeric value by using the formula:
   $Value = (N1 \times 27^3) + (N2 \times 27^2) + (N3 \times 27) + N4$

The base 2 equivalent of the decimal number "Value" is stored in the tag's Chassis Mark field.

Conversion from a base 2 tag format back to the four letters would involve the following, where "Value" is the decimal equivalent of the base 2 value in the Chassis Mark field.

1. $N1 = Value/27^3$ (integer - drop fractions)

2. $N2 = (Value - (N1 \times 27^3))/27^2$ (integer)

3. $N3 = (Value - ((N1 \times 27^3) + (N2 \times 27^2)))/27$ (integer)

4. $N4 = Value - ((N1x27^3) + (N2x27^2) + (N3x27))$

5. Use the letter-to-number assignments referred to above to convert N1 through N4 from a numeric value to its letter equivalent.

### 1.4 Chassis Number

The Chassis Number is encoded into the Tag by converting the decimal value from 0 to 999999 to a binary value (a conversion from base 10 to base 2).

### 1.5 Type Detail Code

To encode the Type Detail Code into the Tag, the decimal value from 0 to 15 must be converted to the equivalent base 2 value. Table D presents a description of each type detail code value. The decimal value 15 represents no type code provided.

**Table D: Data Values for the Type Detail Code - Chassis**

| Value | Description |
|---|---|
| 0 | Extendible |
| 1 | Straight |
| 2 | Combo |
| 3 | Beam Slider |
| 4 | Rail Compatible Chassis, with integral rail wheels |
| 5 | Rail Compatible Chassis, without integral rail wheels |
| 6 | Fixed Length Gooseneck |
| 7 | Platform |
| 8 | Drop Frame |
| 9 | Tri-Purpose |
| 10-14 | Reserved |
| 15 | Others/Not Used |

**Chassis Type Definitions**

Extendible - Chassis capable of expanding or "stretching" to accomodate different size containers.

Straight - Fixed length chassis, also called "flushback", capable of handling one size container; not a gooseneck.

Combo - Fixed length chassis, capable of handling two sizes of containers [also referred to as "eight-pin chassis"]. However, in contrast to Tri-purpose chassis, additional locking pins are not provided to allow an alternate placement location of one smaller size container.

Beam Slider - Chassis capable of expanding or "stretching" to accommodate U.S. Bridge formulas, but not capable of stretching enough to accommodate different size containers.

Rail Compatible Chassis - Chassis capable of operation on railroad without an underlying flatcar platform.

Gooseneck - Chassis with a lowered bed, with a protruding structure to fit in the slot [tunnel] in the bottom of a container. Serves to lower the height of the chassis/container combination to meet clearance requirements. If a gooseneck chassis is also extendible, it should be classified as "Extendible."

Tri-Purpose [or threeway] - Fixed length chassis, capable of handling two sizes of containers. In addition, additional locking pins are provided to allow an alternate placement location of one smaller size container [also referred to as "twelve-pin chassis"].

Platform - Chassis with a platform at the rear; facilitates unloading

### 1.6 Tare Weight

This field indicates the chassis Tare Weight in hundreds of kilograms. To encode the chassis Tare Weight into the Tag, the metric value from 15 to 77 hundred kilograms must be reduced by 14, then converted to its equivalent base 2 value. If a minimum binary value for this field is entered (i.e., 0), it indicates a "does not apply" condition.

### 1.7 Height

The chassis height is measured from the ground to the top of the rear bolster excluding locking pins when the chassis is unladen. To encode the height into the Tag, the decimal value from 40 to 166 centimeters must be reduced by decimal value 39 then converted to the equivalent base 2 value. If a minimum binary value for this field is entered (i.e., 0), it indicates a "does not apply" condition.

### 1.8 Tandem Width

The Tandem Width field indicates the nominal width of the chasssis tandem, defined as the extreme width spanned by the outside tires of an axle. (The Tandem Width is usually 96 or 102 inches). To encode the tandem width into the Tag, use the following table:

| Value | Description |
|---|---|
| 0 | Not Used/Other |
| 1 | 96 Inches/2.5 meters or Less |
| 2 | More than 96 inches/2.5 meters but not more than 102 Inches/2.6 meters |
| 3 | More than 102 inches/2.6 meters |

The decimal value from the table is converted to its base two equivalent for encoding into the tag.

### 1.9 Forward Extension

The Forward Extension field indicates the distance from the center of the kingpin forward to the extreme front protrusion of the chassis, including any nose-mounted gooseneck, electrical box, fixed glad hands, or other protrusion. To encode the Forward Extension into the Tag, the metric value from 30 to 154 centimeters must be reduced by decimal value 28, then divided by two, and then converted to the equivalent base 2 value. If a minimum binary value for this field is entered (i.e., 0), it indicates a "does not apply" condition. If metric values are entered, only even centimeters may be used. (This saves space on the tag).

### 1.10 Kingpin Setting

This is distance from the center of the kingpin forward to the front of the chassis, but excluding any protrusions such as a gooseneck or electrical box. To enter the value into the tag, follow the same procedure as for Forward Extension, above. If metric values are entered, only even centimeters may be used.

### 1.11 Axle Spacing

This is the distance between the centers of the rear axles. To encode the tag, the value of 10 to 40 decimeters is reduced by 9, then converted to the equivalent base 2 value. Use the minimum value (binary 0) for unknown or not used.

### 1.12 Running Gear Location

This is the distance from the rear of the chassis to the point midway between the two axles. To encode the tag, the value of 13 to 43 decimeters is reduced by 12, then converted to the equivalent base 2 value. If unknown or not used, use the minimum value (binary 0). If the chassis is a sliding tandem, use the maximum value of 43 decimeters or 169 inches. For beam sliders, use distance of running gear location in its normal position.

**1.13 Number of Lengths**

This field represents the number of different lengths in which the chassis can be configured. Use 0 for not used, and 7 for 7 or more lengths. To encode the tag, the value of 0 to 7 should be converted to its equivalent binary value.

1.14 Minimum Length

This field indicates the chassis minimum length. Indicate the actual, non-extended extreme length of the chassis, not the nominal length of container which the chassis can handle. [The actual length is needed in loading the chassis on flatcars.] The minimum length is measured while the chassis is in its fully retracted state. If the chassis is a fixed length, then the minimum length simply equals the chassis length. The length field is equivalent to the overall (outside) length of the chassis, including forward protrusions but excluding dock bumpers. To encode the chassis length into the Tag, the metric value from 0 to 2046 is divided by two and then is converted to its equivalent base 2 value. If a minimum binary value for this field is entered (i.e., 0) it indicates a "does not apply" condition. When centimeters are entered, only even values may be used.

**1.15 Maximum Length**

The Maximum Length of the chassis is identified in this field if the user chooses not to use security characters. If the user does not wish to use security nor indicate the maximum length, then this field shall be filled with binary zeros.

To insert Maximum Length, the chassis shall be measured in its fully extended state. In the case of a fixed length chassis, the Maximum Length is equivalent to the chassis length. The Maximum Length is equivalent to the overall (outside) length of the chassis, including forward protrusions but excluding dock bumpers.

To encode the Maximum Length into the Tag, the decimal measurement from 0 to 2046 centimeters must first be converted to an even number. The subsequent steps shall then be used to encode the data. (If inches are entered, the programmer hardware will perform the necessary conversion.)

1. Divide the number by two

2. Convert the resulting decimal number ($D_3D_2D_1D_0$) to a base 37 number ($T_1T_0$) as follows:
   $C = D_3D_2D_1D_0/37$ (Truncate to an Integer Result)

   $T_1 = C + 1$

   $T_0 = D_3D_3D_1D_0 - (Cx37)$ (Truncate to an Integer Result)

3. Use the following table to convert $T_1T_0$ to two alpha-numeric symbols ($A_1A_0$)

| $A_1$ or $A_0$ Character | $T_1$ or $T_0$ Value | $A_1$ or $A_0$ Character | $T_1$ or $T_0$ Value |
|---|---|---|---|
| /(slash) | 0 | H | 18 |
| 0 | 1 | I | 19 |
| 1 | 2 | J | 20 |
| 2 | 3 | K | 21 |
| 3 | 4 | L | 22 |
| 4 | 5 | M | 23 |
| 5 | 6 | N | 24 |
| 6 | 7 | O | 25 |
| 7 | 8 | P | 26 |
| 8 | 9 | Q | 27 |
| 9 | 10 | R | 28 |
| A | 11 | S | 29 |
| B | 12 | T | 30 |
| C | 13 | U | 31 |
| D | 14 | V | 32 |
| E | 15 | W | 33 |
| F | 16 | X | 34 |
| G | 17 | Y | 35 |
| | | Z | 36 |

4. Using the 6-Bit ASCII table presented in Appendix H, find the decimal values associated with $A_1$ $A_0$. Finally, these decimal values must then be converted to corresponding base 2 values.

# STANDARD S-918
## Appendix E
## TAG DATA FORMAT FOR END-OF-TRAIN DEVICE

### 1.0 BITS AVAILABLE FOR GENERAL USE

Fields specified by the Standard are listed in Table A; General Use fields are indicated in bold type. A description of each General Use field is presented in the paragraphs following Table A.

**Table A: Data Field Descriptions for the EOT Device Tag**

| Entry | Bits Required | Tag Data Sequence | Minimum Value | Maximum Value | Units |
|---|---|---|---|---|---|
| **Equipment Group Code** | **5** | **0-4** | **0** | **31** | **Type Code** |
| **Tag Type** | **2** | **5-6** | **1** | **4** | **Type Code** |
| **Equipment Initial (Mark)** | **19** | **7-25** | **A___** | **ZZZZ** | **Alpha** |
| **EOT Number** | **20** | **26-45** | **0** | **999999** | **Numeric** |
| **EOT Type Code** | **2** | **46-47** | **0** | **3** | **Type Code** |
| **Side Indicator Code** | **1** | **48** | **0** | **1** | **Side Code** |
| **Spare** | **41** | **49-59,64-93** | | **Available for Owner's Use** | |
| **Reserved** | **12** | **94-105** | **Reserved for Future Use by AAR** | | |
| First Check Sum | 2 | 60-61 | | | |
| Reserved Frame Marker | 2 | 62-63 | | | |
| Security | 12 | 106-117 | | Reserved for Security or limited Owner's use | |
| Data Format Code | 6 | 118-123 | | | |
| Second Check Sum | 2 | 124-125 | | | |
| Frame Marker | 2 | 126-127 | | | |

The fields are arranged in a hierarchical fashion in order to expedite processing by the data processor. It is intended that the data processor will first look at the Data Format Code to determine if the tag should be ignored. For example, in some cases the data processor will wish to ignore all tags except those specified as rail (AAR Standard) or marine intermodal (ISO Standard) tags.

Once the Data Format Code has been processed, then the data processor will look to the Tag Type to determine the configuration, capabilities, and memory capacity of the tag.

Next, the data processor will examine the Equipment Group Code to determine if the tagged equipment is relevant.

The order in which the remaining fields are processed will be dictated by the particular application.

### 1.1 Equipment Group Code

This is a numeric field having a value from 0 to 31 that indicates the general type of equipment. A table of values for this field is indicated below. Note that only major categories of equipment types are indicated in this field and other fields are allotted to indicate further details. The Equipment Group Code for a EOT Device is decimal 6 (binary 00110).

**Table B: Data Values for the Equipment Group Code**

| Value | Description | Value | Description |
|---|---|---|---|
| 0 | Other | 16 | Reserved |
| 1 | Reserved | 17 | Tractor (Power) |
| 2 | Reserved | 18 | Straight Truck |
| 3 | Reserved | 19 | Railcar |
| 4 | Reserved | 20 | Dolly |
| 5 | Locomotive | 21 | Trailer |
| 6 | End-of-Train Device | 22 | Reserved |
| 7 | Reserved | 23 | Reserved |
| 8 | Reserved | 24 | Reserved |
| 9 | Reserved | 25 | Reserved |
| 10 | Intermodal Container | 26 | Reserved |
| 11 | Reserved | 27 | Chassis |
| 12 | Reserved | 28 | Reserved |
| 13 | Reserved | 29 | Reserved |
| 14 | Non-Revenue Rail | 30 | Reserved |
| 15 | Reserved | 31 | Reserved |

### 1.2 Tag Type

The Tag Type indicates the configuration, capability, and memory size of the Tag, as indicated in Table C:

**Table C: Data Values for the Tag Type Field**

| Decimal Value | Description |
|---|---|
| 1 | Reserved |
| 2 | Tag described by the AAR Standard |
| 3 | Multiple Frame Tag |
| 4 | Reserved |

To code the Tag Type value into the Tag, the decimal value is reduced by one and converted to its base 2 equivalent.

### 1.3 Equipment Initial

The Equipment Initial is composed of four (4) letters and can be represented as C1; C2; C3; C4. To code this information in the tag, the possible letters represented by C1 will be assigned to the following decimal values: A=0, B=1, C=2, ....Z=25. The letters C2, C3 and C4 will be assigned the following values: Blank =0, A=1, B=2, ...Z=26. This code assignment allows for an Initial of less than four characters, with the actual characters left justified, and the remainder of the field padded with blanks.

Conversion from alpha to numeric would involve the following:

1. Determine the numeric equivalent of characters C1 through C4. This will result in four numeric values; N1 through N4.

2. Convert N1 through N4 into one numeric value by using the formula:
   $Value = (N1 \times 27^3) + (N2 \times 27^2) + (N3 \times 27) + N4$

The base 2 equivalent of the decimal number "Value" is stored in the tag's Equipment Initial field.

Conversion from a base 2 tag format back to the four letters would involve the following, where "Value" is the decimal equivalent of the base 2 value in the Equipment Initial field.

1. $N1 = Value/27^3$ (integer - drop fractions)

2. $N2 = (Value - (N1 \times 27^3))/27^2$ (integer)

3. $N3 = (Value - ((N1 \times 27^3) + (N2 \times 27^2)))/27$ (integer)

4. $N4 = Value - ((N1x27^3) + (N2x27^2) + (N3x27))$

5. Use the letter-to-number assignments referred to above to convert N1 through N4 from a numeric value to its letter equivalent.

### 1.4 EOT Number

The EOT Number is encoded into the tag by converting the decimal value from 0 to 999999 to a binary value (a conversion from base 10 to base 2).

### 1.5 EOT Type

This field provides a generic description of the EOT device. The appropriate value from the following Table D should be converted to base 2 and encoded into the tag.

**Table D: Data Values For EOT Type Code**

| Decimal Value | Description |
|---|---|
| 0 | Active EOT, AAR-Compatible |
| 1 | Active EOT, Not AAR-Compatible |
| 2 | Passive EOT |
| 3 | Not Used/Unknown |

### 1.6 Side Indicator Code

The Side Indicator Code indicates whether the tag is installed on the left or right side of the EOT. The left or right is determined in reference to a person standing behind and facing an EOT properly mounted on a train. The right side is assigned a binary value 1 and the left side is assigned a binary value 0.

# STANDARD S-918
## Appendix F
## TAG DATA FORMAT FOR THE INTERMODAL CONTAINER

### 1.0 BITS AVAILABLE FOR GENERAL USE

Fields specified by the Standard are listed in Table A; General Use fields are indicated in bold type. A description of each General Use field is presented in the paragraphs following Table A.

The procedures and definitions of how to measure the containers' physical characteristics specified in Table A are documented by the International Standards Organization.

**Table A: Data Field Descriptions for the Container Tag**

| Entry | Bits Required | Tag Data Sequence | Minimum Value | Maximum Value | Units |
|---|---|---|---|---|---|
| **Equipment Group Code** | **5** | **0-4** | **0** | **31** | **Type Code** |
| **Tag Type** | **2** | **5-6** | **1** | **4** | **Type Code** |
| **Owner's Code (Initial) *** | **19** | **7-25** | **A___** | **ZZZZ** | **Alpha** |
| **Identification Number** | **20** | **26-45** | **0** | **999999** | **Numeric** |
| **Check Digit** | **4** | **46-49** | **0** | **9** | **Numeric** |
| **Length** | **11** | **50-59,64** | **0** | **2000** | **Centimeters** |
| | | | **[0** | **805** | **Inches]** |
| First Check Sum | 2 | 60-61 | | | |
| Reserved Frame Marker | 2 | 62-63 | | | |
| **Height** | **9** | **65-73** | **0** | **500** | **Centimeters** |
| | | | **[0** | **392** | **Half Inches]** |
| **Width** | **7** | **74-80** | **200** | **300** | **Centimeters** |
| | | | **[78** | **118** | **Inches]** |
| **Container Type Code** | **7** | **81-87** | **1** | **128** | **Type Code** |
| **Maximum Gross Weight** | **9** | **88-96** | **45** | **455** | **Hundred Kg** |
| | | | **[99** | **1004** | **Hundred Lbs]** |
| **Tare Weight** | **7** | **97-103** | **0** | **91** | **Hundred Kg** |
| | | | **[0** | **200** | **Hundred Lbs]** |
| **Spare** | **2** | **104-105** | | | **Reserved** |
| Security | 12 | 106-117 | | | Reserved for Security or limited Owner's use |
| Data Format Code | 6 | 118-123 | | | |
| Second Check Sum | 2 | 124-125 | | | |
| Frame Marker | 2 | 126-127 | | | |

* When the Owner's Code is not the same as the Container Initial (Mark), use the Container Initial (Mark) in this field.

The fields are arranged in a hierarchical fashion in order to expedite processing by the data processor. It is intended that the data processor will first look at the Data Format Code to determine if the Tag should be ignored. For example, in some cases the data processor will wish to ignore all Tags except those specified as rail (AAR Standard) or marine intermodal (ISO Standard) Tags.

Once the Data Format Code has been processed, then the data processor will look to the Tag Type to determine the configuration, capabilities, and memory capacity of the Tag.

Next, the data processor will examine the Equipment Group Code to determine if the tagged equipment is relevant. The order in which the remaining fields are processed will be dictated by the particular application.

### 1.1 Equipment Group Code

This is a numeric field having a value from 0 to 31 that indicates the general type of equipment. A table of values for this field is indicated below. Note that only major categories of equipment types are indicated in this field and other fields are allotted to indicate further details. The Equipment Group Code for a container is decimal 10 (binary 01010).

**Table B: Data Values for the Equipment Group Code**

| Value | Description | Value | Description |
|---|---|---|---|
| 0 | Other | 16 | Reserved |
| 1 | Reserved | 17 | Tractor (Power) |
| 2 | Reserved | 18 | Straight Truck |
| 3 | Reserved | 19 | Railcar |
| 4 | Reserved | 20 | Dolly |
| 5 | Locomotive | 21 | Trailer |
| 6 | End-of-Train Device | 22 | Reserved |
| 7 | Reserved | 23 | Reserved |
| 8 | Reserved | 24 | Reserved |
| 9 | Reserved | 25 | Reserved |
| 10 | Intermodal Container | 26 | Reserved |
| 11 | Reserved | 27 | Chassis |
| 12 | Reserved | 28 | Reserved |
| 13 | Reserved | 29 | Reserved |
| 14 | Non-Revenue Rail | 30 | Reserved |
| 15 | Reserved | 31 | Reserved |

### 1.2 Tag Type

The Tag Type indicates the configuration, capability, and memory size of the tag, as indicated in Table C.

**Table C: Data Values for the Tag Type Field**

| Decimal Value | Description |
|---|---|
| 1 | Reserved |
| 2 | Tag described by the AAR Standard and ANSI and ISO Container Standards |
| 3 | Multiple Frame Tag |
| 4 | Reserved |

To code the Tag Type value into the tag, the decimal value is reduced by one and converted to its base 2 equivalent.

### 1.3 Owner's Code/Container Mark

The Owner's Code/Container Mark is composed of four (4) letters and can be represented as C1; C2; C3; C4. To code this information in the Tag, the possible letters represented by C1 will be assigned to the following decimal values: A=0, B=1, C=2, ....Z=25. The letters C2, C3 and C4 will be assigned the following values: Blank=0, A=1, B=2, ...Z=26. This code assignment allows for an Owner's Code of less than four characters, with the actual characters left justified, and the remainder of the field padded with blanks.

Conversion from alpha to numeric would involve the following:

1. Determine the numeric equivalent of characters C1 through C4. This will result in four numeric values; N1 through N4.

2. Convert N1 through N4 into one numeric value by using the formula:

$$\text{Value} = (N1 \times 27^3) + (N2 \times 27^2) + (N3 \times 27) + N4$$

The base 2 equivalent of the decimal number "Value" is stored in the tag's Owner's Code field.

Conversion from a base 2 tag format back to the four letters would involve the following, where "Value" is the decimal equivalent of the base 2 value in the Owner's Code field.

1. $N1 = Value/27^3$ (integer - drop fractions)

2. $N2 = (Value - (N1x27^3))/27^2$ (integer)

3. $N3 = (Value - ((N1x27^3) + (N2x27^2)))/27$ (integer)

4. $N4 = Value - ((N1x27^3) + (N2x27^2) + (N3x27))$

5. Use the letter-to-number assignments referred to above to convert N1 through N4 from a numeric value to its letter equivalent.

**1.4 Identification Number**

The Identification Number is encoded into the Tag by converting the decimal value from 0 to 999999 to a binary value (a conversion from base 10 to base 2).

**1.5 Check Digit**

The Check Digit is used as a means of verifying the accuracy of the Owner's Code and Identification Number. The Check Digit is calculated according to an algorithm specified in the International Standards Organization Document 6346: 1984. The Check Digit is encoded into the Tag by converting the decimal value from 0 to 9 to its equivalent base 2 value.

**1.6 Length**

To encode the Length into the Tag, the metric value from 0 to 2000 must be converted to the equivalent base 2 value. The Length is equal to the overall (outside) length of the container.

**1.7 Height**

This field indicates the container height in centimeters or half inches. To encode the container Height into the Tag, the metric value from 0 to 500 centimeters must be converted to its equivalent base 2 value.

**1.8 Width**

This field indicates the container width in centimeters. The Width is equivalent to the overall (outside) width of the container. To encode the Width into the Tag, the metric value from 200 to 300 is reduced by 200, then converted to its equivalent base 2 value.

**1.9 Container Type Code**

The Container Type Code is represented by the decimal values from 1 to 128 as defined in the International Standards Organization document ISO 6346-1984 (E), Annex G. To encode the value into the Tag, the decimal value must be reduced by one then converted to its equivalent base 2 value.

**1.10 Maximum Gross Weight**

The Maximum Gross Weight is measured in hundreds of kilograms or pounds. To encode the Maximum Gross Weight into the Tag, the metric value from 45 to 455 must be reduced by 45, then converted to the equivalent base 2 value.

**1.11 Tare Weight**

The Tare Weight field is indicated in hundreds of kilograms or pounds. To encode the tare weight into the Tag, the metric value from 0 to 91 hundred kilograms is converted to the equivalent base 2 value.

**2.0 ANSI MH5.1.9-1990**

The American National Standards Institute's American National Standard for Freight Containers - Automatic Identification ANSI MH5.1.9-1990 and International Standards Organization Standard 10374 specify an automatic identification standard for containers. This AAR AEI Standard for containers is compatible with the ANSI Standard and the ISO Standard, except that this AAR Standard requires operability at only one of the frequency ranges that the ISO Standard requires.

# STANDARD S-918
## Appendix G
## 7-BIT ASCII TABLE

| Graphic or Control | ASCII Decimal | Graphic or Control | ASCII Decimal | Graphic or Control | ASCII Decimal |
|---|---|---|---|---|---|
| | | . | 46 | ] | 93 |
| NUL | 0 | / | 47 | ^(↑) | 94 |
| SOH | 1 | 0 | 48 | _(←) | 95 |
| STX | 2 | 1 | 49 | ` | 96 |
| ETX | 3 | 2 | 50 | a | 97 |
| EOT | 4 | 3 | 51 | b | 98 |
| ENQ | 5 | 4 | 52 | c | 99 |
| ACK | 6 | 5 | 53 | d | 100 |
| BEL | 7 | 6 | 54 | e | 101 |
| BS | 8 | 7 | 55 | f | 102 |
| HT | 9 | 8 | 56 | g | 103 |
| LF | 10 | 9 | 57 | h | 104 |
| VT | 11 | : | 58 | i | 105 |
| FF | 12 | ; | 59 | j | 106 |
| CR | 13 | < | 60 | k | 107 |
| SO | 14 | = | 61 | l | 108 |
| SI | 15 | > | 62 | m | 109 |
| DLE | 16 | ? | 63 | n | 110 |
| DC1 (X-ON) | 17 | @ | 64 | o | 111 |
| DC2 (TAPE) | 18 | A | 65 | p | 112 |
| DC3 (X-OFF) | 19 | B | 66 | q | 113 |
| CD4 (TAPE) | 20 | C | 67 | r | 114 |
| NAK | 21 | D | 68 | s | 115 |
| SYN | 22 | E | 69 | t | 116 |
| ETB | 23 | F | 70 | u | 117 |
| CAN | 24 | G | 71 | v | 118 |
| EM | 25 | H | 72 | w | 119 |
| SUB | 26 | I | 73 | x | 120 |
| ESC | 27 | J | 74 | y | 121 |
| FS | 28 | K | 75 | z | 122 |
| GS | 29 | L | 76 | { | 123 |
| RS | 30 | M | 77 | \| | 124 |
| US | 31 | N | 78 | } (Alt Mode) | 126 |
| SP | 32 | O | 79 | DEL (Rub Out) | 127 |
| ! | 33 | P | 80 | | |
| " | 34 | Q | 81 | | |
| # | 35 | R | 82 | | |
| $ | 36 | S | 83 | | |
| % | 37 | T | 84 | | |
| & | 38 | U | 85 | | |
| ' | 39 | V | 86 | | |
| ( | 40 | W | 87 | | |
| ) | 41 | X | 88 | | |
| * | 42 | Y | 89 | | |
| + | 43 | Z | 90 | | |
| , | 44 | [ | 91 | | |
| - | 45 | \ | 92 | | |

# STANDARD S-918
## APPENDIX H
## 6-Bit ASCII Table

| Six-Bit ASCII Character | Decimal Value | Six-Bit ASCII Character | Decimal Value | Six-Bit ASCII Character | Decimal Value |
|---|---|---|---|---|---|
| (space) | 0 | 6 | 22 | L | 44 |
| ! | 1 | 7 | 23 | M | 45 |
| " | 2 | 8 | 24 | N | 46 |
| # | 3 | 9 | 25 | 0 | 47 |
| $ | 4 | : | 26 | P | 48 |
| % | 5 | ; | 27 | Q | 49 |
| & | 6 | < | 28 | R | 50 |
| ' | 7 | = | 29 | S | 51 |
| ( | 8 | > | 30 | T | 52 |
| ) | 9 | ? | 31 | U | 53 |
| * | 10 | @ | 32 | V | 54 |
| + | 11 | A | 33 | W | 55 |
| , | 12 | B | 34 | X | 56 |
| - | 13 | C | 35 | Y | 57 |
| . | 14 | D | 36 | Z | 58 |
| / | 15 | E | 37 | [ | 59 |
| 0 | 16 | F | 38 | \ | 60 |
| 1 | 17 | G | 39 | ] | 61 |
| 2 | 18 | H | 40 | ^ | 62 |
| 3 | 19 | I | 41 | _(underline) | 63 |
| 4 | 20 | J | 42 | | |
| 5 | 21 | K | 43 | | |

# STANDARD S-918
## Appendix I
## FORMAT OF DATA SENT FROM READER TO DATA PROCESSOR

This section is included to provide a specific description as to how data is output from the Reader in the current Amtech system. This Standard does not require that this data output format be utilized.

### Reader Functions

The Reader is responsible for decoding the radio frequency information collected by the Reader's Antenna, into binary information equivalent to the 128 bits of data stored in the Tag. As part of this decoding exercise, the Reader must first collect the data and check for various errors. Check sums and Frame Markers are used to detect errors and synchronize the data collection process. Both of these fields are for internal use only and are not transmitted from the Reader to the data processor. All other fields are relayed from the Reader to the data processor.

### Encoding the Data into ASCII Format

The Reader uses the standard ASCII data format for communicating with the data processor. In order to transfer the 120 bits (128 minus the Frame Markers and Check Sums) of data using 7-bit ASCII, the Reader must split apart the 120 bits into smaller, more manageable pieces. To accomplish this, the Reader partitions the 120 bits into contiguous 6-bit partitions. This means that there are 20 6-bit partitions created. The base 2 value of each partition is converted to a decimal value which has a corresponding ASCII value which falls somewhat short of the full 7-bit ASCII table. In order to code the 6-bit partitions into ASCII coding, the Reader uses the 6-bit ASCII table.

The sole purpose for limiting the partitions to 6-bits and using the 6-bit ASCII coding is to provide a set of ASCII characters that does not include the various command and control characters indicated in the 7-bit ASCII table. For example, the 7-bit ASCII table would allow the Reader to transmit a control-C, form feed, carriage return, etc. to a data processor or modem which may result in undesirable actions.

Thus, the Reader partitions 20 6-bit segments and encodes this data into a 6-bit ASCII format. This 6-bit ASCII format is then converted to 7-bit ASCII for transmission to the data processor. This conversion to 7-bit ASCII is done by adding 32 decimal to the 6-bit value. For example, the base 2 value 010000 would be converted to the 6-bit ASCII character "0" (zero). This ASCII character corresponds to a table value of 48 in the 7-bit ASCII table. The Reader converts the 6-bit value to the 7-bit value and transmits the 7-bit value to the data processor.

### Data Encode and Decode Example

Suppose an installer programs a Tag with the following information:

| | |
|---|---|
| Equipment Group Code | D(Locomotive) |
| Tag Type | 128 bit Tag (AAR Type) |
| Owner's Code | KMCX |
| Locomotive Number | 1587234 |
| Length | 120 |
| No. of Axles | 4 |
| Bearing Type Code | 2 |
| Side Indicator | 1(right side) |
| Security | ## |

The corresponding base 2 values stored in the Tag would be:

| | |
|---|---|
| Equipment Group Code | 00101 |
| Tag Type | 01 |
| Owner's Code | 0110010011001001100 |
| Locomotive Number | 00011000001110000010010 |
| Length | 001111000 |
| No. of Axles | 00100 |
| First Check Sum | 11 |
| Reserved Frame Marker | 11 |
| Bearing Type Code | 010 |
| Side Indicator Code | 1 |
| Spare/Reserved | 00000000000000000000000000000000 |
| Security | 000011000011 |
| Data Format Code | 110011 |
| Second Check Sum | 11 |
| Frame Marker | Special Bit Pattern |

The corresponding 20 characters sent by the Reader to the data processor are:

*LF3!@X(CP10 ----- ##S (Underscore represents a blank)

Also, the actual data from the Reader may have additional characters before and after the above character string which are used to indicate time and date, antenna number, etc.

**Reader Transmission Formats**

The reader transmits the following information the host computer:

- o Tag data,
- o Error messages,
- o Sensor input reports,
- o Sign-on message, and
- o Modem connect or disconnect messages.

Tag ID codes, error messages, sensor input reports, and modem connect/disconnect messages can have optional information appended to them. Whenever time or time and date

are appended, they apply equally to Tag ID codes, error messages, sensor input reports, and modem connection messages. Auxiliary information can be appended to Tag ID codes and sensor input reports, but not to error reports or modem messages.

**Tag Data Content Only**

The tag data is transmitted with a "start of message" sign followed by 20 characters. Spaces are legitimate characters, and if the tag data is not 20 characters long, spaces are appended to the tag data to make 20 characters. For example:

#12345678901234567890
#ABC 12347655 TARE

To transmit tag data with no appended information, enter both #300 and #310 commands.

The "#" sign is a "start of message" character. This character may be assigned six different values as follows:

# [23 hex]
‘ [60 hex]
{ [8B hex]
| [7C hex]
} [7D hex]
~ [7E hex]

Of these choices, it is recommended that the tilde [~] be used as the start of message character, although the other start of message characters may be used at the discretion of the user. Although the "#" sign is used as the sample start of message character here, it may occur within the data portion of the message, and thus should be avoided as a start of message character.

**Error Message Only**

Error message are in the format of the "#", the word "Error" and a two-digit error code. For example:

#Error 02
#Error 03

To transmit the error code only, enter the #300 command. This command removes the time and date.

**Sensor Input Reports Only**

Sensor input reports are in the format of the "#", the words "SENSOR INPUT REPORT",

and a space. There are 21 characters total, including the "#" character.

Note: Sensor input reports are not automatic, but must be requested through the #6901 SENSOR INPUT REPORTS ENABLED command.

**Sign-on Message**

The sign-on message is in the following format:

#Model A11200 ver X.X SNYYYYY
#Copyright 1988 AMTECH Corp.

The sign-on message never contains any appended information.

**Time Only Appended**

Time can be appended to tag data, error messages (except Error 01), sensor input reports, and modem connect/disconnect messages. The format of the transmission is as follows:

#<string>&HH:MM:SS.hh

where, <string> is the tag data, error message, or sensor input report. HH:MM:SS.hh represent hours, minutes, seconds, and hundredths of seconds, respectively. Colons(:) separate hours, minutes, and seconds; a period (.) separates hundredths of seconds. The "&" character provides a means for the host computer to determine if time is appended to the string. Note: hundredths of seconds are not appended to error messages.

**Time and Date Appended**

Time and date can be appended to tag data, error messages (except Error 01), sensor input reports, and modem connect/disconnect messages. The format of the transmission is as follows:

#<string>&HH:MM:SS.hh MM/DD/YY

The format is exactly like "time only appended" described above, except that two spaces and the date follow the time. MM, DD, and YY represent the month, day, and two-digit year, respectively. The forward slash (/) separates the month, day and year entries. Note: hundredths of seconds are not appended to error messages.

**Auxiliary Information Only Appended**

Auxiliary information can be appended to ID codes and sensor input reports. Auxiliary information is never appended to error or modem messages. Auxiliary information consists of Reader number, Antenna number, number of reads of previous Tag, and sensor input status. The format is as follows:

#<string> % XX-Y-ZZ-Q

where, <string> is the tag data or sensor input report. XX represents the Reader number in hex from 00 to FF; Y represents the Antenna number (0 or 1 for Antenna, M for manual ID entry, S for sensor input report); ZZ is the number of reads of the previous Tag in hex from 00 to FF; and Q represents the sensor input status in hex from 0 to F. The "%" character provides a means for the host computer to determine if auxiliary information is appended to the string. The "-" separates the values of the auxiliary information.

**Time and Auxiliary Information Appended**

Time and auxiliary information can be appended to tag data and sensor input reports. The format is as follows:

#<string>&HH:MM:SS.hh%XX-Y-ZZ-Q

The time and auxiliary information follow the formats described above.

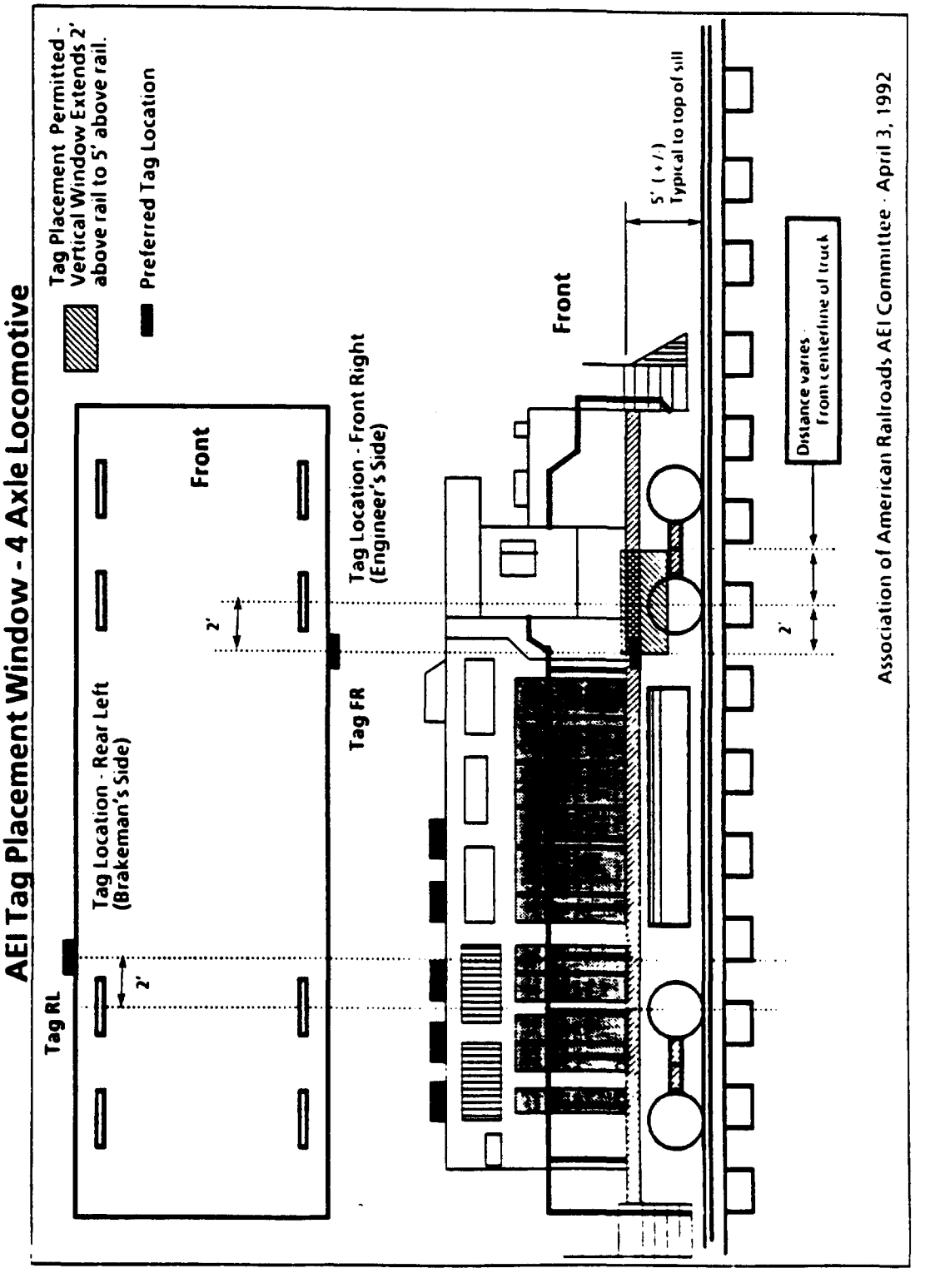
**Time, Date, and Auxiliary Information Appended**

Time, date, and auxiliary information can be appended to tag data and sensor input reports. This is the factory setting of the Reader. The format is as follows:

#<string>&HH:MM:SS.hh MM/DD/YY%XX-Y-ZZ-Q

The time, date, and auxiliary information follow the formats described above.

## EXHIBIT A


AEI Tag Placement Window - 4 Axle Locomotive
Tag Placement Permitted - Vertical Window Extends 2' above rail to 5' above rail.
Preferred Tag Location
Front
Tag Location - Front Right (Engineer's Side)
Tag FR
Tag Location - Rear Left (Brakeman's Side)
Tag RL
2'
Front
5' (+/-) Typical to top of sill
Distance varies from centerline of truck
2'
Association of American Railroads AEI Committee - April 3, 1992

## EXHIBIT A (Continued)

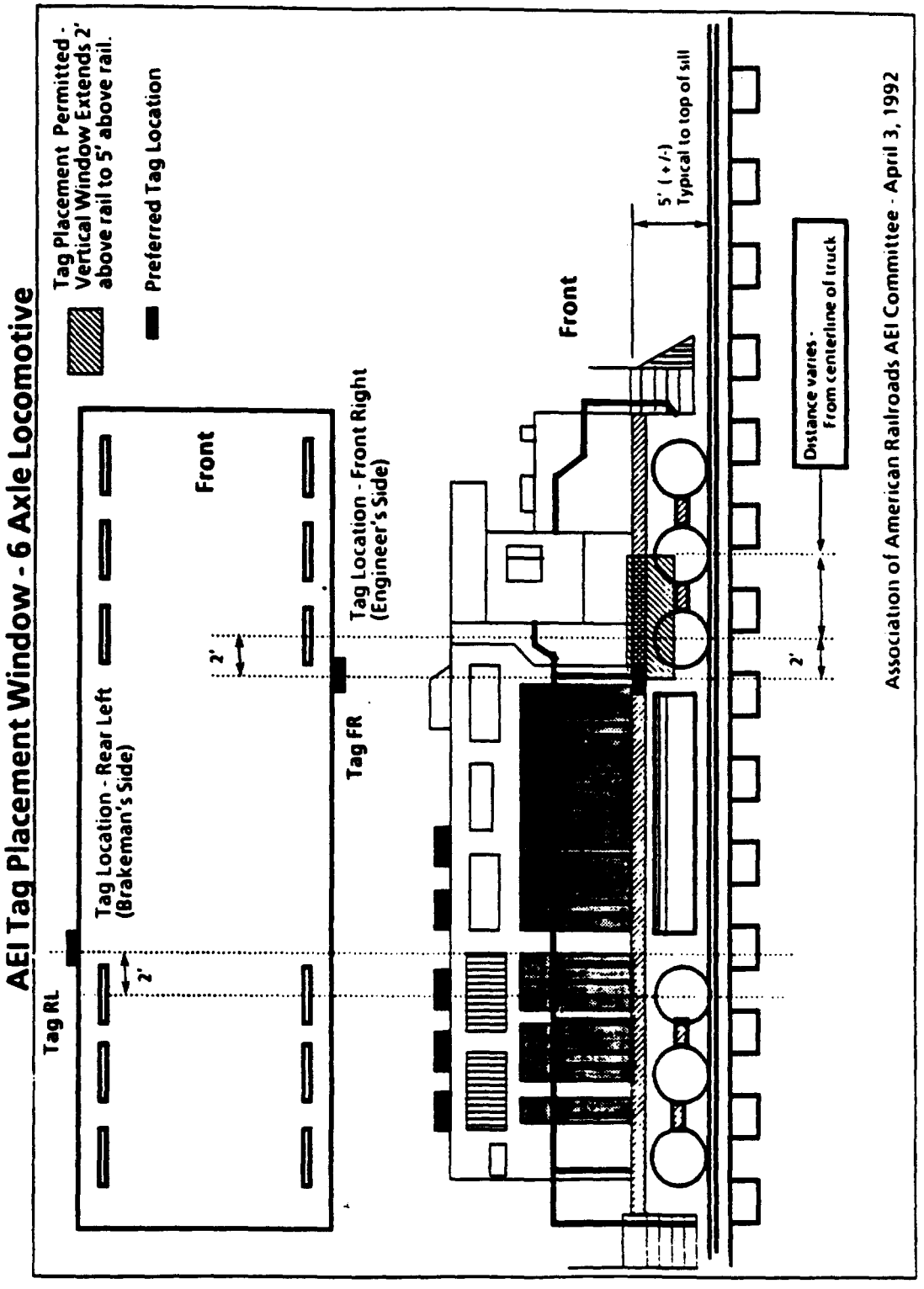


EXHIBIT A (Continued)